

Strip
Planting for
Flood Control
By
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STRIP PLANTING FOR FLOOD CONTROL¹

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Floods have caused tremendous damage in the territory represented by the Allegheny Section of the Society of American Foresters. For example, the March 1936 flood in Pennsylvania alone caused physical and direct flood losses estimated at 212 million dollars.³ Although man cannot prevent floods such as that of March 1936, he can, to a great extent, take measures to minimize their effects.

REMEDIAL measures such as reforestation have been advocated by foresters for flood control. Nevertheless the choice of species, mixtures, spacing, and methods of planting some 225,000 acres in the states of Pennsylvania, New Jersey, Maryland, and Delaware has been made with little consideration to other uses than timber production.

In order to evaluate a reforestation program for flood control in the Youghiogheny River watershed (southwestern Pennsylvania, Maryland, and West Virginia) the author reviewed the literature and interviewed public and private agencies. Not only were there no stream flow records of run-off from watersheds which had been reforested, but there was also an almost entire lack of forest influences data. For example, does reforestation increase infiltration, that is, the rate at which water is taken up by the soil? Is there any increase in the rate of infiltration before the crowns close? After the crowns close? If so, would it be advisable to plant trees characterized by quick crown closure? If so, what species are characterized by quick crown closure? Since the development of a humus layer is considered to be associated with infiltration, should we not consider planting species which quickly develop a humus layer? What are these species? Under what species is there the least liability of frozen ground and the best possibility of keeping the soil open to absorb the melting snows and flood producing rains? How much longer do white pine plantations retard snow melt than idle lands? How would snow melt be affected by different forest tree species? By different spacings? All these questions should be answered in evaluating reforestation for flood control.

Since crown closure in coniferous plantations appears to be related to retardation of snow melt, to reduction of depth and extent of frozen ground, and to increased soil porosity, it follows that earlier flood control benefits can be obtained from quick growing species and close spacing. Accordingly, detailed studies of crown closure and humus development were made in 17 fully stocked coniferous plantations. These plantations had been established in open fields on well drained soils in or adjacent to the Youghiogheny River watershed in southwestern Pennsylvania. These studies show that the crowns of Scotch pine close at six to eight years when planted 4 by 4 and 5 by 5 feet. Pitch pine is but slightly slower. Both species when planted 6 by 6 and 7 by 7 feet require one to three years longer for the crowns to close. The crowns of these pines close from two to four years earlier than red pine and white pine. Norway spruce is the slowest in rapidity of crown closure, from 12 to 15 years being required for crown closure when planted 4 by 4 and 5 by 5 feet. Although these tentative conclusions are based on a limited number of plantations, they were substantiated by observations in the extensive plantations of the Willmore Real Estate Company near Johnstown, Pa.

The early development and accumulation of a humus layer appears to be related to increased infiltration. Measurements of humus layers on the plots where crown closure was studied indicate that pitch pine planted 5 by 5 feet develops a humus layer of 1½ to 2 inches in 15 years on well drained silt loam soils. Humus layers in Scotch pine, white pine, and red pine plantations of similar age tended to be slightly thinner but there were numerous exceptions. In contrast, little or no humus layer was found in Norway spruce plantations; the oldest one studied was 19 years old.

The water holding capacity of the humus layer in plantations appears to merit investigation. Near the base of a 15-year-old pitch pine tree

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²Senior representative of the Forest Service, flood control survey, Youghiogheny River Watershed.

³Ryder, C. E. The floods of March 1936 in Pennsylvania. Penna. Dept. of Forests and Waters. 1936.

planted 5 by 5 feet, an accumulation of humus 4 inches deep possessed a total water holding capacity of 0.7 inches. Pitch pine appears to build up a cone shaped humus layer around the base of the tree to an unusual degree. In an area long protected from fire a cone shaped humus layer 19 inches thick was observed around a stump. At a distance of 24 inches from the stump the humus was only 7 inches in thickness. Even if humus layers averaging only 2 to 3 inches in depth can be developed over a large area, the additional storage capacity is by no means infinitesimal.

Although additional studies are greatly needed it would appear that early flood control benefits can be obtained particularly from Scotch pine and pitch pine in southwestern Pennsylvania. Forest management of submarginal farm lands, however, involves not only substantial benefits from flood control, but also from timber management, game management, and recreation. Pure plantings in narrow strips of species primarily of value for each of these objectives appear to be a solution.

The strips should follow the contour approximately except on broad hilltops where it may be more advantageous to plant the strips at right angles to the prevailing winds. Although no information is available as to the best length of the strips, lengths up to 1,000 feet should be satisfac-

tory. Strips 10 to 20 rows wide are suggested since they are convenient for management. The suppression of one species by another is largely eliminated. In some areas, however, such strips may be too wide to secure the benefits of mixed planting as regards insect and disease outbreaks.

As an illustration of the possibilities of the strip method of reforestation, a detailed plan for an idle field located on a hillside in southwestern Pennsylvania has been presented in Figure 1. Cultivated fields lie above and below the area.

First game strip.—Planting the first belt, 10 feet wide, below the cultivated hilltop with shrubs for game food will also provide some protection against erosion.

First flood control strip.—The establishment of belts of Scotch pine and pitch pine spaced 5 by 5 feet below the first game belt will not only provide early shelter for game but also early flood control benefits. Shortly after the closure of the crowns in six to ten years, 1 to 2 inches of humus will accumulate and the soil will become more porous. In addition, appreciable amounts of precipitation will be intercepted by the trees. Thus conditions will be favorable not only for absorbing all the precipitation falling within the belt, but also run-off from the cultivated field.

Coincident with crown closure, the strip will act as a windbreak and thus reduce the drifting



Fig. 1.—Strip system of planting on an idle field located on a hillside 580 x 1,000 feet.

of snow and the probability of frozen ground. The heavy foliage will also retard snow melt. Thus run-off from the frozen field can usually be absorbed by this belt.

Second game strip.—By leaving a 20-foot interval unplanted below the flood control strip, the owner can reduce planting costs as well as leave existing herbaceous and woody shrub food plants. This strip also makes the interior of the planting area more accessible for management work, hunting, and recreation.

First timber strip.—Below the second game strip, a strip of red pine spaced 7 by 7 feet has been established at lower planting costs than the conventional 6 by 6 feet spacing. The necessity for early thinnings has been eliminated. However, crown closure will occur six to eight years later than in the flood control belt and humus development will be slower. Thus early flood control benefits have been sacrificed for reduced costs of timber production.

Third game strip.—By leaving a 20-foot interval below the timber strip, the planter may obtain the benefits previously described in the second game strip.

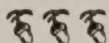
Second flood control strip.—Pitch pine planted 5 by 5 feet will result in early flood control benefits as previously described in the first flood control strip. Thus conditions will be favorable for

the absorption of run-off from the timber and game belts prior to crown closure, and an extra zone will be provided to absorb exceptionally heavy run-off from the cultivated field above the plantation.

Timber strip.—Belts of red oak spaced 7 by 7 feet, white pine spaced 5 by 5 feet, and yellow poplar spaced 6 by 6 feet below the second flood control strip utilize the most productive portion of the planting site. On the lower part of the slope, the soils are deepest, the soil moisture conditions most favorable, and wind movement least. If cultivation of the hardwood areas is necessary to insure establishment, the hardwood belts are readily accessible from the cultivated field in the valley. The belt of white pine between the hardwood areas serves as the third flood control strip.

The number of trees, 14,950, required to plant the entire field by the strip method is not only 7 percent less than that required for 6 by 6 spacing, but earlier flood control and game benefits have been also obtained by the strip system.

The method of site preparation has not been discussed since either contour furrowing, scalping, or no site preparation could be used with the strip method. Furthermore, the extent to which contour furrows should be recommended cannot be made until extensive infiltration studies are completed.



WOOD WASTE RECLAMATION IN CANADA

WITH Canada at war and every effort being put forth to obtain the maximum use of natural resources, the Dominion's great pulp and paper industry is keenly alive to the necessity of curtailing waste wherever economically possible. Waste reclamation is receiving special attention from the Forest Products Laboratories, Department of Mines and Resources. The laboratories carry out their work in close collaboration with industrial associations interested in pulp, lumber, and other wood products, with provincial governments, with other departments of the Dominion government, and with Canadian Trade Commissioners and timber commissioners in other countries.

Screenings in pulp mills formerly considered as waste are now treated in special refiners to produce fibres suitable for making board fillers, corrugating paper, newsprint, and building board. In some paper mills fine fibres, formerly lost in mill effluent, are now recovered by various means, of which air flotation is the most striking. In Canadian mills waste liquor from sulphite pulping now yields baker's yeast and vanillin.

In Canada each year more than a million tons of solids dissolved out of pulpwood by the sulphite process are discharged into Canadian waters.

